Implementation of effective blended periconception lifestyle care in a tertiary hospital in the Netherlands: a cross-sectional study on determinants and patient satisfaction

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ABSTRACT

Objective To identify implementation determinants of blended periconception lifestyle care, and to evaluate patient satisfaction.

Design Cross-sectional study.

Setting The outpatient clinic of the department of Obstetrics and Gynaecology of the Erasmus MC.

Participants Implementation part: counsellors providing blended periconception lifestyle care. Patient satisfaction part: women who received blended periconception lifestyle care.

Methods Blended periconception lifestyle care, including face-to-face counselling and 26 weeks of lifestyle coaching via the online platform 'Smarter Pregnancy', was implemented between June–December 2018. The Measurement Instrument for Determinants of Innovations questionnaire was used as input for the consolidated framework for implementation research to assess determinants of implementation. To evaluate patient satisfaction, patients receiving lifestyle care filled out an evaluation questionnaire, including questions on the needs for lifestyle counselling, information provision during counselling, and motivation and lifestyle change after counselling.

Primary and secondary outcome measures Identification of implementation determinants and the level of patient satisfaction.

Results Facilitators were reported in the implementation domains 'characteristics of the intervention' and 'characteristics of the individuals'. Barriers were in the implementation domains 'inner setting' and 'implementation process'. Regarding patient satisfaction on nutrition counselling, 31% of the respondents wanted information prior to the counselling session, 22% received new information after consultation, 51% got motivated to change and 40% changed their nutritional behaviour.

Conclusions A considerable number of patients improved lifestyle after counselling, although, a relatively small number wanted lifestyle counselling prior to consultation. This study underlines the importance of implementation science and the information it provides for improving the implementation process.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study is the first to systematically assess the implementation of blended periconception lifestyle care, focusing on both determinants of implementation using a validated questionnaire and patient satisfaction.
⇒ This study included a relatively large group of (pre) pregnant women, and thereby, generated relevant information to promote the successful implementation of periconception lifestyle care on a large scale.
⇒ The patients response rate was 36.3%, and although this is considered an average response rate for this type of study in the literature, this rate may impact generalisability of the results.

INTRODUCTION

The detrimental effects of poor periconception lifestyle behaviours on reproductive outcome, pregnancy complications and future health are broadly acknowledged.[1–4] However, adopting a healthy lifestyle is challenging and individual attempts to behavioural change often do not lead to satisfactory results and sustainable change.[5] As a result, several effective interventions to improve lifestyle behaviours among (pre) pregnant women have been developed during the past decades.[6 7] The most promising results are being achieved by interventions that combine face-to-face visits and eHealth ('blended care'), as this treatment modality improves engagement, and self-management, and decreases intervention resistance and the number of hospital consultations.[8 9] In 2018, the department of Obstetrics and Gynecology of the Erasmus MC already developed and evaluated blended periconception lifestyle care, combining the outpatient lifestyle counselling service 'Healthy Pregnancy' and the eHealth platform 'Smarter Pregnancy'.[10]

The blended approach resulted in improvements of all targeted lifestyle behaviours, namely an increase in fruit and vegetable intake and folic acid supplement use, and a decrease in alcohol consumption and tobacco use. However, successful implementation in clinical practice is difficult, due to the complexity and heterogeneity of patients, providers and clinical settings.[11] Moreover, evaluation of implementation processes is often lacking, which results in implementation failure leading to low effectiveness rates of new healthcare services, although initial studies demonstrated high effectiveness.[12]

The aim of the study is twofold: to identify implementation determinants, both facilitators and barriers, of blended periconception lifestyle care, and to evaluate patient satisfaction. The results of our study provide leads for the successful implementation of future lifestyle care projects, by producing actionable findings enabling current local implementation of the approach, and future wide implementation.

METHODS

Study design and participants

The current study had a cross-sectional design and used two questionnaires:

- Adjusted version of the Measurement Instrument for Determinants of Innovations (MIDI) questionnaire[13] (online supplemental table 1), meant for evaluation of experiences of the counsellors of blended periconception lifestyle care.
- Healthcare evaluation questionnaire (online supplemental table 2), intended for which was send out to patients that received blended periconception lifestyle care.

Implemented innovation

Blended periconception lifestyle care was implemented between 18 June 2018 and 31 December 2018 at the outpatient clinics (OPC) of the Department of Obstetrics and Gynaecology at the Erasmus MC, a tertiary care centre. It comprised two integrated parts: the OPC Healthy Pregnancy and the eHealth lifestyle coaching programme Smarter Pregnancy (www.smarterpregnancy.co.uk and www.slimmerzwanger.nl). In preparation for the face-to-face counselling, patients were asked to fill out the baseline screening of the Smarter Pregnancy coaching programme. Based on the baseline screening, the counsellor provided the patient couple with a tailored lifestyle advice, and guidance with possible options for lifestyle alterations was offered and discussed. All counsellors were medical doctor and were doing a PhD in the research group Periconception Epidemiology at the department of Obstetrics and Gynaecology. All have followed and successfully completed a course on motivational interviewing. Accordingly, they are well educated experts in the field of lifestyle counselling in the periconception period. The baseline screening allowed for a personalised advice during the 26-week period of coaching provided through the eHealth platform Smarter Pregnancy. Previous research[4 6 14 15] showed that this eHealth intervention is effective in improving lifestyle behaviours. We decided to use the same intervention and to change neither the content, neither the length of the intervention, since this might influence the effectiveness.

The underlying theory is that the 26-week programme includes the periconception period, defined as the 14 weeks before and up and until 10 weeks after conception, and an evaluation 2 weeks later.[16] Moreover, according to the Transtheoretical Model, or Stages of Change Model, after a period of 6 months, people have modified their problem behaviour and have acquired new healthy behaviours.[17] Participating couples, both women and their male partners, received up to three short motivating and supporting messages per week via email. These messages included tips, recommendations to achieve a healthier lifestyle, vouchers for folic acid supplements, and seasonal recipes. A previous study addressed and evaluated the effectiveness of blended periconception lifestyle care and showed that this approach is effective on enhancing fruit and vegetable intake and folic acid supplement use and decreasing alcohol consumption and tobacco use.[18]

Measurement instruments and data collection

Determinants of implementation

To determine which factors, either facilitators or barriers, influence the implementation of blended periconception lifestyle care, we used the validated MIDI questionnaire.[19] As of yet, only a handful of validated questionnaires exist to assess implementation determinants.[20 21] We chose to use the MIDI for several reasons. First, it is the most widely cited and used questionnaire to assess implementation determinants. Next, the MIDI has been developed specifically to assess the implementation of care innovations in the Netherlands, and therefore, suitable for use in Dutch care settings. Also, no validated questionnaire yet exist to measure the constructs of the Consolidated Framework of Implementation Research (CFIR) framework. Adaptations are often made to implementation questionnaires as they need to be aligned to the context, setting and intervention type examined.[22–24] It is even recommended to do so, to improve fit and appropriateness of the questions posed.[13] All adaptations made were discussed thoroughly with healthcare researchers involved in the development of the preconception lifestyle care intervention, one of them being a implementation expert.

The MIDI questionnaire as developed by Fleuren *et al*[19] enquires on 29 determinants of implementation. To improve the applicability of this questionnaire in the current setting, four adaptations were made to the original MIDI. All adaptations were discussed with an implementation specialist until consensus was reached. Moreover, all adaptations and corresponding rationale to MIDI questionnaire are presented in table 1. The first adaptation consisted of the addition of six determinants derived from the initial framework of Fleuren *et al*[25]:

Table 1 Adaptations and corresponding rationale to MIDI questionnaire

Adaptations	Rationale
The first adaptation consisted of the addition of six determinants derived from the initial framework of Fleuren *et al*: *relative advantage*, *skills*, *ownership*, *collaboration*, *preparation time* and *involvement of users in the development of the intervention*.	These items were not included in the MIDI questionnaire, but were part of the original MIDI framework of Fleuren[19] and several other highly cited, theory-driven implementation research frameworks.[29 40] After a rapid evidence assessment and research team debate, we found that neglecting to include and thereby research these items would deliver an incomplete picture of implementation determinants at play.
The second adaptation was the addition of five items after comprehensive discussion with senior researchers involved in the innovation development and implementation. Two of these items were related to the innovation itself, that is, *organisation* and *adaptability*, and two other to innovation strategies, that is, *training prior to implementation*, *instructions*' The final item referred to the user of the innovation (counsellor), that is, *role clarity*. Items were phrased as suggested by the MIDI, and all were assessed by a 5-point Likert scale ranging from 'completely disagree' to 'totally agree'.	Exploratory qualitative research, consisting of discussions between senior researchers and an implementation specialist, yielded determinants that needed to be added in the quantitative assessment to ensure a comprehensive review of the implementation process. Moreover, we adhered to the due diligence obligations of the MIDI manual.
The third adaptation consisted of excluding the category *socio-political contex*t, which included the determinant *legislation and regulations*.	We decided to exclude this category as we wanted to focus on the identification of determinants that were changeable. We needed to minimise the length of the questionnaire and the research burden placed on participants, as professionals indicated they already faced a high work load and had little time left to participate in research activities.
The final adaptation consisted of transforming the original dichotomous yes/no MIDI-items *formal ratification by management* and *coordinator*, into 5-point Likert-type scaled items.	We wanted to be able to compare items, and decided that transformation to the item style and Likert scale as used in the other MIDI items was necessary.

MIDI, Measurement Instrument for Determinants of Innovations.

relative advantage, *skills*, *ownership*, *collaboration*, *preparation time* and *involvement of users in the development of the intervention*. The second adaptation was the addition of five items after comprehensive discussion with senior researchers involved in the innovation development and implementation. Two of these items were related to the innovation itself, that is, *organization* and *adaptability*, and two other to innovation strategies, that is, *training prior to implementation*, *instructions*. The final item referred to the user of the innovation (counsellor), i.e. *role clarity*. Items were phrased as suggested by the MIDI, and all were assessed by a 5-point Likert scale[26] ranging from 'completely disagree' to 'totally agree'. The third adaptation consisted of excluding the category *socio-political context*, which included the determinant *legislation and regulations*. The final adaptation consisted of transforming the original dichotomous yes/no MIDI-items *formal ratification by management* and *coordinator*, into 5-point Likert-type scaled items.

The total questionnaire comprised 32 questions, with answer categories varying from 1, 'totally disagree', to 5, 'totally agree'. All counsellors (n=7) were invited to fill out the adjusted version of the validated MIDI questionnaire.

Patient satisfaction

There is great variation in the definition of the concept of patient satisfaction in healthcare.[27] We decided to include questions on the needs for lifestyle counselling, information provision during counselling, and motivation and actual lifestyle change after counselling as relevant aspects of patient satisfaction. The questionnaire to evaluate patient satisfaction with blended periconception lifestyle care was initially composed by three clinically and scientifically experienced professionals involved in the development and provision of the care approach. An implementation expert was consulted to advise us on the content and formulation of questions. Next, 10 other involved healthcare professionals, all medical doctors, scored the relevance of each question. Moreover, a woman who was contemplating pregnancy and a pregnant woman were asked for her opinion as well. The questions with a mean relevance score of 8 or higher were included in the final questionnaire.

Patients who had received blended periconception lifestyle care were invited to fill out the questionnaire 4 weeks after they had the counselling session. They received the invitation digitally or by post, depending on their preferences. Two weeks after the initial invitation, they received a reminder if the questionnaire was not completed.

It is known that interventions will be performed differently as they move from an effectiveness study into clinical daily practice, which is called 'program drift'.[28] We

preferred to measure patient satisfaction in clinical daily practice, instead of a research setting that might not reflect real-world performance of blended periconception lifestyle care. Therefore, we decided to evaluate patient satisfaction with blended periconception lifestyle care in 2020, deliberately a considerable time after the innovative approach was already implemented as standard care.

Outcomes

Main outcomes were

- The implementation determinants discovered by the MIDI questionnaire and, subsequently, by the CFIR.
- The patient satisfaction with the implemented innovation, and differences between subgroups by age (<30 and >30 years of age) and pregnancy status (non-pregnant and pregnant).

Data analyses

Implementation determinants

The results of MIDI questionnaires yielded information on determinants of implementation. The CFIR was used to guide further systematic assessment of multilevel implementation contexts to identify determinants of implementation.[29] This widely cited research framework further enabled us to identify the context-driven and connected determinants of the implementation of the innovation. Since the CFIR is internationally used, the transformation from MIDI constructs to CFIR constructs increases the comparability of the current study with other implementation studies. In total, the CFIR contains 26 constructs divided into 5 domains: *characteristics of individuals*, *inner setting*, *intervention characteristics*, *outer setting*, and *process*. Each question of the MIDI questionnaire was reflective of 1 of the 26 CFIR constructs. A list of MIDI questions, MIDI constructs and corresponding CFIR constructs was composed after extensive internal discussion with an implementation specialist and is presented in online supplemental table 1. Eventually, items in the filled out questionnaire that were most frequently mentioned as either facilitating or hindering the implementation process were appointed as facilitators or barriers.

Patient satisfaction

The results from the patient satisfaction questionnaire will be presented as percentages of answers given on each category of the 5-point Likert scale. Subgroup analyses will be performed for pregnancy status (non-pregnant and pregnant), and age (<30 and >30 years). Subgroups of patients aged below and above 30 years were composed, since the risk of pregnancy complications, increases after the age of 30, and lifestyle counselling to improve lifestyle behaviours with a subsequent pregnancy complication risk reduction is relevant for this group in particular.

Table 2 Characteristics of respondents on patient satisfaction survey

Characteristic	Respondents (n=489)
Age (years), median (IQR)	33.2 (6.7)
Pregnant (yes), n (%)	218 (44.6)
Referred by, n (%)	
Dept. of reproductive medicine	177 (36.2)
Antenatal OPC	118 (24.1)
Preconception health OPC	32 (6.6)
Early pregnancy OPC	30 (6.1)
Dept. of foetal medicine	19 (3.9)
I don't know	113 (23.1)

OPC, outpatient clinic.

RESULTS

Study population

Determinants of implementation

All counsellors involved in the counselling sessions (n=7) were included and anonymously filled out the adapted version of the MIDI questionnaire (response rate 100%) between January 2020 and February 2020. The mean years of experience as a medical doctor among the counsellors was 3.6 years (range: 3–5 years).

Patient satisfaction

The evaluation questionnaire was sent out to 1348 patients who received blended periconception lifestyle care between March 2020 and February 2021. In total, 489 patients filled out the questionnaire (response rate 36.3%). Characteristics of patients are shown in table 2.

Determinants of implementation

Measurement Instrument for Determinants of Innovations

The responses of the counsellors on the adapted version of the MIDI questionnaire are shown in online supplemental table 3. The counsellors indicated several MIDI constructs as facilitating factors in the implementation process, mainly *correctness*, *adaptability*, *complexity*, *social support* (from other counsellors), *subjective norm*, *knowledge*, *skills*, *role clarity*, *self-efficacy*, *evidence strength and quality*, *access to information innovation use*, *material resources and facilities*, *time available*, *collaboration*, *training* and *coordinator*.

Barriers, determinants that hinder the implementation process, reported by counsellors in the MIDI questionnaire are *social support* (from project initiator and project coordinator), *evaluation and feedback* and *involvement in development*.

Consolidated Framework of Implementation Research

The discovered MIDI facilitating constructs were converted in the following CFIR constructs: *evidence strength and quality*, *complexity*, *adaptability*, *self-efficacy*, *access to knowledge and information*, *available resources* and *networks and communication*. The discovered MIDI constructs

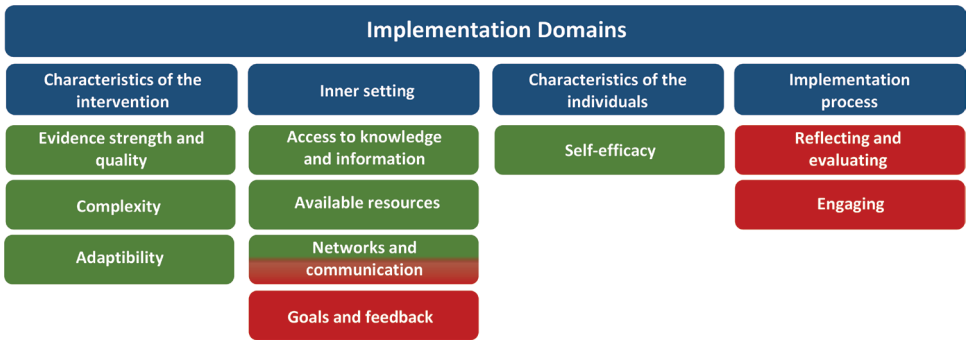

Figure 1 Retrospective evaluation of implementation determinants using Consolidated Framework of Implementation Research (CFIR). The blue column headings represent the different implementation domains. The corresponding implementation determinants are shown in green (facilitator) and red (barrier).

acting as barriers in the implementation process were also converted to CFIR constructs: *reflecting and evaluating*, *goals and feedback*, *networks and communication*, and *engaging*.

The identified implementation determinants, both barriers and facilitators, are displayed in figure 1. The facilitators are mainly located in the domains *characteristics of the intervention*, *inner setting*, and *characteristics of the individual*. On the contrary, barriers mostly occurred in the domains *inner setting* and *implementation process*.

Patient satisfaction

Blended periconception lifestyle care consisted of attending the counselling session (either via telephone, video or face-to-face consultation) and following the Smarter Pregnancy eHealth programme. Patient satisfaction of each component is questioned separately.

The mean age of the respondents was 33.2 years of which 218 (45%) were pregnant.

Referral and type of consultation

Out of 489 respondents, 177 (36%) were referred by the department of reproductive medicine, 118 (24%) by an antenatal consultation OPC, 32 (7%) by a preconception advice OPC, 30 (6%) by an early pregnancy OPC, 19 (4%) by the department of prenatal and fetal medicine, and 113 (23%) respondents could not recollect their referral (figure 2). Two hundred sixty-six respondents (57%) received a face-to-face consultation, 60 (13%) had a telephone consultation and 143 (30%) received a video consultation, of which 80 women strongly agreed that starting the video consultation was easy (figure 3).

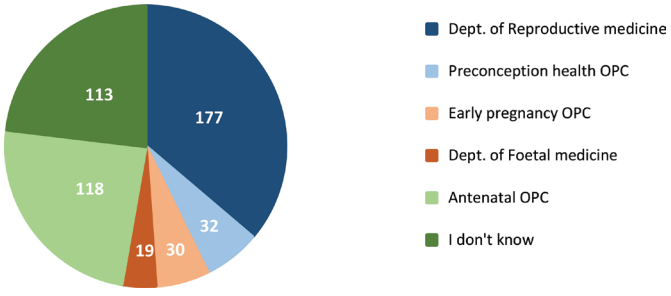

Figure 2 Referring outpatient clinics (OPC) and corresponding number of referred patients

Counselling consultation: expectations and effects

During the counselling session, patients are informed and motivated to change lifestyle behaviours, such as nutrition, folic acid and other supplements usage, smoking, alcohol consumption, physical exercise, stress and sleep. For each separate lifestyle behaviour, all respondents were asked if they cared for new information, if they actually received new information, if this led to motivation to change a specific behaviour and if they have changed and been able to maintain a change after the counselling session (figure 4). Regarding nutrition, for instance, 31% of the respondents wanted information prior to the counselling session, 22% received new information after the counselling, 51% got motivated to change and 40% indeed changed a lifestyle behaviour. The largest number of respondents that changed their lifestyle behaviour after the counselling were for nutrition and (folic acid) supplement use, 40% and 35%, respectively. After the counselling session, 13% and 15% of the respondents reported a behavioural change on smoking and alcohol consumption, respectively. During the counselling session, 24% of respondents reported that they did not receive new information, even though this part of respondents as well reported that they wanted information prior to consultation.

Subgroup analyses based on pregnancy status are shown in online supplemental table 4. Non-pregnant women reported a higher need for information prior to the consultation on all lifestyle behaviours, except for sleep and stress. A higher percentage of non-pregnant women reported to have received new information during the consultation on nutrition, folic acid and other supplements, and responded on all lifestyle behaviours to be motivated to change after the consultation, compared with pregnant women. Importantly, on all lifestyle behaviours, except for stress and sleep, a higher percentage of non-pregnant women reported to have actually changed their behaviour.

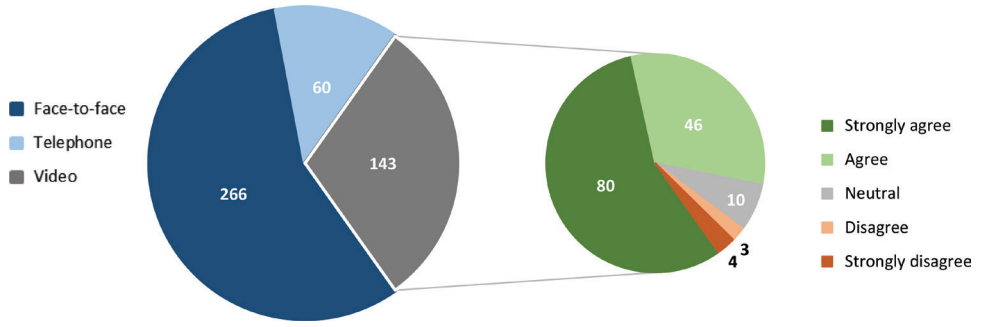

Figure 3 Number of patients that received a certain care modality.

Subgroup analyses based on age are shown in online supplemental table 5. These analyses showed no evident differences between the group aged below 30 years and the group aged above 30 years both on expectations as well as on effects of the counselling consultation.

eHealth lifestyle coaching programme marter regnancy

As a part of blended periconception lifestyle care, all patients were invited to activate the eHealth coaching programme Smarter Pregnancy prior to or during the counselling session. Sixty-one per cent (n=257) of the respondents activated the Smarter Pregnancy programme. Out of the 39% who did not activate the programme, 61% reported that they did not want to activate the programme, 27% did not know the possibility of activating the programme, 8% did not have an activation code, and 4% did not technically manage to activate the programme. Among the respondents who activated the programme, 19% (n=49) reported that

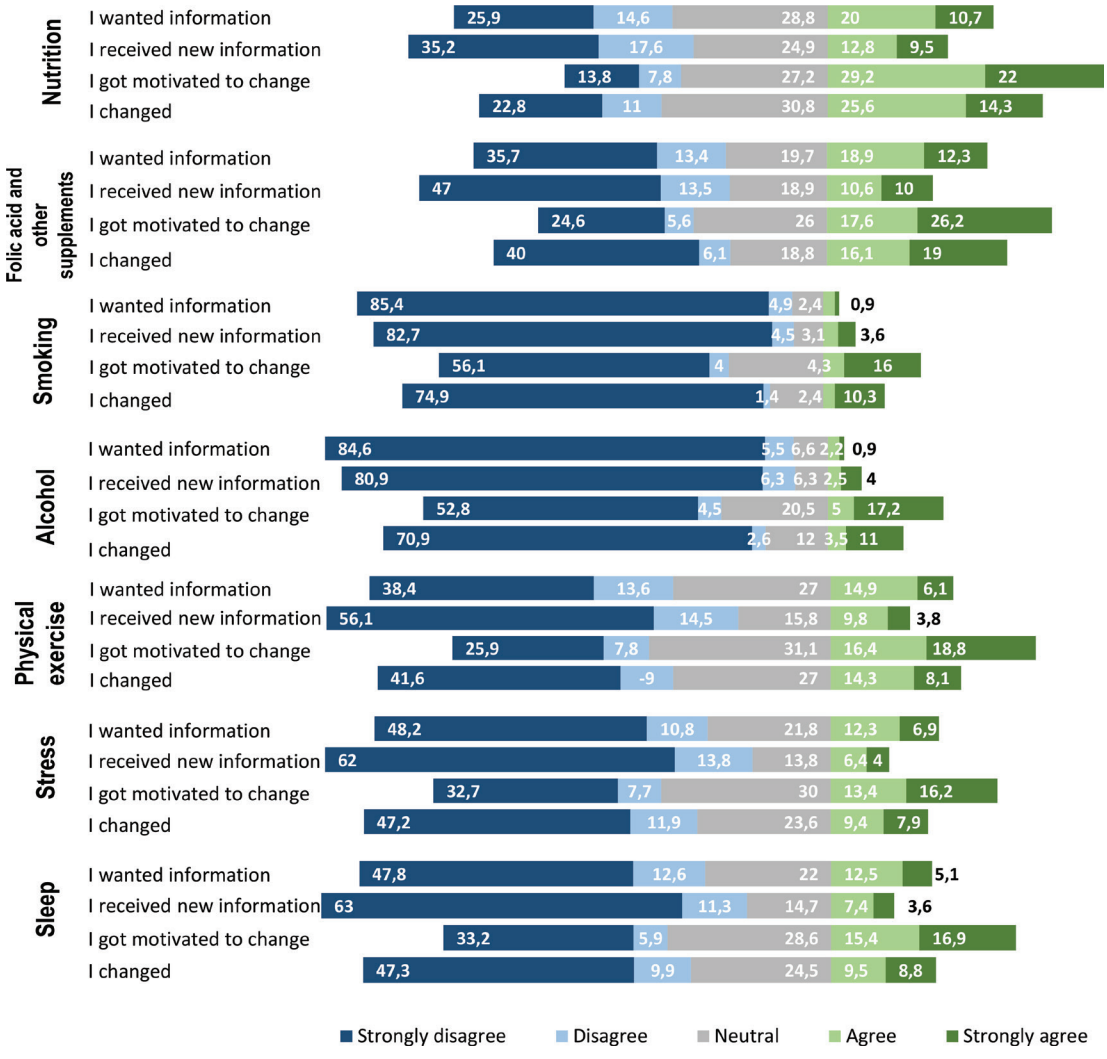

Figure 4 Expectations and effects of counselling session.

Smarter Pregnancy helped them with improving their lifestyle.

DISCUSSION

Main findings

Counsellors of blended periconception lifestyle care considered the domains *characteristics of the intervention* and *characteristics of the individuals* as facilitating factors in the implementation process. The identified barriers were *reflecting and evaluating*, *goals and feedback*, *networks and communication* and *engaging*. We developed strategies to overcome the identified barriers, which further facilitated successful implementation.

Regarding nutrition, a considerable number of patients (40%) changed their lifestyle behaviours after receiving blended periconception lifestyle care, even though the call for lifestyle counselling prior to the consultation was relatively low (31%).

Composing strategies to overcome identified implementation barriers

The article of Powell *et al* presented methods to build strategies to overcome barriers.[30] The identified barriers in the current study included *reflecting and evaluating*, *goals and feedback*, *networks and communication,* and *engaging*. For the barrier *reflecting and evaluating*, they suggested to 'develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learnt, and support one another's learning'. We decided to put the implementation of blended periconception lifestyle care as a standard item on the monthly meeting of our sub-department as a strategy to overcome the barrier *reflecting and evaluating*. Moreover, we initiated additional training sessions on lifestyle behaviours for counsellors given by a nutritionist.

To further improve *networks and communication*, Powell *et al* suggested to 'identify and build on existing high-quality working relationships within and outside the organisation'. We aimed that discussing the implementation of blended periconception lifestyle care on our monthly meeting would be an occasion for all stakeholders to improve internal communication. For the construct *goals and feedback'* Powell *et al* suggested to 'collect and summarize clinical performance data over a specified time period and give it to clinicians and administrators to monitor, evaluate, and modify provider behavior'. As a strategy to overcome the barrier *goals and feedback*, we initiated a weekly update by email to all stakeholders involved in the implementation process, with topics as the number of counselled patients per week, monthly trends in the number of counselling sessions, and aspects of the implementation that went well or could be improved. We expect that implementing the above mentioned strategies can also improve the identified barrier *engaging*.

Strategies composed to further improve patient satisfaction

First, an activation link for the Smarter Pregnancy coaching programme is now sent digitally, instead of an activation code in the patient information folder, with the aim to increase the number of patients that activate the coaching programme. Second, we improved the explanation on the importance of having a healthy lifestyle in the patient information folder, in order to raise awareness prior to consultation and, thereby, achieve a higher number of patients that changed lifestyle behaviour.

Strengths and limitations

This study is the first to systematically assess the implementation process of blended periconception lifestyle care, identify determinants of implementation and simultaneously involved the target group by evaluating patient satisfaction and experience. The iterative process of identifying implementation determinants provided insights in the successful implementation of periconception lifestyle counselling and is of great value to others who aim to implement certain interventions in clinical practice.

This study generated relevant information to promote the successful implementation of lifestyle care for (pre) pregnant women on a large scale, based on a relatively large group of (pre)pregnant women. We used the validated MIDI questionnaire to identify facilitators and barriers to the implementation process, which allowed us to study predefined determinants. Exploring not predefined determinants was beyond the bounds of possibility with this measurement instrument and could have been possible by carrying out focus groups or interviews. However, we considered the MIDI questionnaire, especially after our adaptations, as comprehensive and we did not expect any major determinants to be ignored or missed. Due to time and resource limitations, the adapted MIDI was not pretested. Pretesting could have potentially enhanced validity, and we therefore suggest other researchers to pretest the adaptations made to the MIDI questionnaire before using the tool again in practice.

In addition, no information was collected on participant's medical history and educational level. Yet, subanalyses to assess the association between these characteristics and study outcomes was not possible.

The patients response rate was 36.3%, and we can only speculate what the experience of the remaining patients has been. However, characteristics as age and pregnancy status of the patients who filled out the evaluation questionnaire did not differ evidently with our previously published paper on blended periconception lifestyle care. This study contained a complete set of patients who received blended periconception lifestyle care (n=450).[10]

Interpretation

Our study identified that the main barriers in the implementation process included *reflecting and evaluating*, *goals and feedback*, *networks and communication,* and *engaging*, which is in line with findings of other studies evaluating implementation of interventions in healthcare.[31 32]

The fact that the barriers were mostly external and the facilitators were mostly internal could indicate that some form of self-serving bias is present in our data.[33]

Counsellors were perhaps unintentionally more prone to, although erroneously, attribute success to internal factors, and failure to external factors.

Value-based healthcare has gained increasing interest since Michael Porter in 2010 strongly emphasised that high value for patients must become the overarching goal of healthcare delivery.[34] Evaluating the call for lifestyle counselling by healthcare providers as well as patients is an aspect that contributes to shared decision-making and value-based healthcare. The patient's call for lifestyle counselling is often low,[35] as the current study demonstrates as well, which in our opinion reflects the negligence of the lifelong importance of adhering to a healthy lifestyle. Moreover, (pre)pregnant women are relatively young and healthy, in general, and do not consider themselves as at risk for adverse health outcomes. However, as is shown by our study, despite a low call for lifestyle counselling, an increased number of patients got motivated to change and changed their lifestyle behaviours after the counselling session. For instance, 40% of women improved their nutritional intake after blended periconception lifestyle care, which is comparable to other, even more extensive, interventions that focused on lifestyle improvement in individuals at risk for cardiovascular disease.[36] Hence, this proves the capability of blended periconception lifestyle care in informing, motivating and activating a group of women that might be unaware of the effects of lifestyle improvement on health outcomes. So, blended periconception lifestyle care is of value to (pre)pregnant women and, consequently, contributes to value-based healthcare.

Practical and research recommendations

Implementation research is often a neglected step, but essential in translating research evidence to clinical practice. Therefore, implementation research should be an integrated part of clinical research to maximise health impact.[37] Hybrid effectiveness-implementation research designs, which combine elements of clinical research and implementation research to understand both patient and implementation outcomes in a single study, could be an option to reduce the time it takes to move from clinical research to public health impact.[38]

The current study showed that more non-pregnant women were interested in lifestyle counselling and changed their lifestyle compared with pregnant women, which demonstrates that blended periconception lifestyle care is more effective in non-pregnant women. Moreover, in the preconception period, lifestyle improvements still have the time and the potential to enhance fertility and early embryonic health,[39] in contrast to lifestyle improvement when pregnancy is already well underway. We, therefore, strongly emphasise the importance of preconception care and counselling as standard care in clinical practice.

Contributors RS-T initiated the project. RMJJvdK provided implementation expertise in study design and data analysis. MvdW collected and analysed the data and wrote the original draft of the article. SS and LvR contributed to data analyses. SS, RMJJvdK, LvR and RS-T reviewed and edited the original draft. RS-T took responsibility for the data as a whole and the content of the manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s)

Ethics approval This study was approved by the medical ethics and institutional review board of the Erasmus MC, Rotterdam, the Netherlands (MEC-2018-1232). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

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